

11/2/01

Aquifer Exemption Criteria Guidance

The following questions should be answered to determine if an aquifer can be exempted under §146.4 of Title 40 of the Code of Federal Regulations. A zone of injection (aquifer) which is a USDW (Underground Source of Drinking Water) can be deemed exempted by answering no to question #1 and answering yes to any part of question #2 or question #3. The addendum on the following pages should be consulted to assist the applicant in answering parts of questions #2 and #3.

- | | Yes | No |
|--|-------------|-------------|
| 1. Is zone of injection (aquifer) currently being used as a source of drinking water? | <u>X</u> | <u> </u> |
| 2. If the answer is yes to one of the four questions listed below, then the zone of injection cannot now and will not in the future serve as a source of drinking water | | |
| (a) Is the zone of injection in a mineral, hydrocarbon or geothermal energy producing zone, or can it be demonstrated as part of a permit application for a Class II or III operation to contain minerals or hydrocarbons that considering their quantity and location are expected to be commercially producible? | <u> </u> | <u> </u> |
| (b) Is the zone of injection situated at a depth or location which makes recovery of water for drinking water purposes economically or technologically impractical? | <u>X</u> | <u> </u> |

Yes No

(c) Is the zone of injection so contaminated that it would be economically or technologically impractical to render that water fit for human consumption?

X _____

(d) Is the zone of injection located over a Class III well mining area subject to subsidence or catastrophic collapse?

_____ _____

3. Is the total dissolve solids content of the ground water more than 3,000 and less than 10,000 mg/l and it is not reasonably expected to supply a public water system (Question #3 should be answered in conjunction with question #2 parts b and c. If the answer to parts b and c of question #2 is yes then the answer to question #3 is yes. However, if the answer to both parts is no, then the answer to question #3 is also no).

X _____

ADDENDUM

In order to answer the four questions associated with question #2, valid support should be shown and stated for each answer.

For question (2a), a sample acquired using a formation tester or coring tool would be required to show if the aquifer contained any producible levels of minerals or hydrocarbons. This would be coupled with reserve calculations and rate of return projections for the aquifer in question. With the above information, EPA would be able to determine whether the applicant has successfully demonstrated, as part of a permit application for a Class II or III operation, that the minerals or hydrocarbons contained in the aquifer are commercially producible.

Structural contour maps (Top of Sand and Bottom of Sand) and Cross-Sections for the zone of injection, along with any available radioactive tracer surveys, would infer if injection is going into a geothermal producing aquifer where steam is produced underground and at the surface.

X For questions (2b) and (2c), an analysis coupled with technological considerations would be required from the applicant to determine if the aquifer's water could be economically pumped to the surface and be made fit for consumption. Specifically, the applicant would be required to calculate the optimum annual yield of the aquifer and the net present value associated with the development and operation of the aquifer as a water supply source. The optimum annual yield would be determined by identifying the location of groundwater wells which would maximize water output without dangerous depletion of the storage reserve. The net present value would be determined by identifying all capital and operating costs associated with the water project and discounting these costs over the life of the project (typically 20 years). Some of these capital and operational costs include the following:

Groundwater Aquifer Development

A. Capital Costs

1. Groundwater Rights
2. Water Wells
3. Pumping Stations
4. Transmission Lines
5. Administration, Legal, Engineering, and Right-of-Way

B. Annual Operational and Maintenance

1. Electrical
 - a. Water Wells
 - b. Pumping Stations
2. Maintenance
 - a. Parts
 - b. Contract Labor

Water Treatment Plant

A. Capital Costs

1. Surface Water Rights
2. Raw Water Pumping Stations
3. Transmission Lines
4. Water Treatment Plant
5. Administrative, Legal, Engineering, and Right-of-Way

B. Annual Operational and Maintenance Costs

1. Electrical
 - a. Raw water intake pump
 - b. Water Treatment Plant

2. Chemical

- a. Alum
- b. Lime
- c. Carbon

3. Maintenance

- a. Parts
- b. Contract Labor

4. Personnel

The net present value and optimum annual yield value would be used by EPA to determine whether water recovery from the aquifer is economically feasible.

For question (2d), structural contour maps (Top of Sand) and cross-sections for both the aquifer and the zone being mined would be required to determine if the aquifer is located over a Class III well mining area subject to subsidence or catastrophic collapse. Also, pore pressure information from drilling and mud logs should be submitted as well.

In addition, the permit applicant may be requested to provide the following information:

1. Topographic Map: USGS Quadrangle sheet as base map
 - a. Surface facilities, intake and discharge structures, and all hazardous waste, treatment storage or disposal facilities
 - b. Project Area
 - c. Public water supply facilities
2. Topographic Map (same scale as above), within the area of review the map must show:

- a. The number, name, and location of all producing wells, injection wells, irrigation, water supply, enhanced recovery, dry holes, surface bodies of water, springs, mines (surface and subsurface)
- b. Roads, residences and faults (if known or suspected)
- c. Wells, springs, other surface water bodies, and drinking water wells located within one quarter mile of the proposed injection well

Note: A list of names and mailing addresses of property holders and water rights holders should be provided for public notification if necessary. These names should be included on the map or as an attachment.

3. Surface Geologic Map
4. Structural Contour Map (on top of injection formation) ?
5. Geologic Cross-Sections (2 perpendicular sections)
 - a. Geologic Formations
 - b. Structural Features
 - c. Shallow Aquifers
 - d. TDS Levels for each Formation
 - e. Faults, Fractures

6. Stratigraphic Column (by formation)

- a. Lithology
- b. Mineralogy
- c. Physical Features (texture bedding)
- d. Thickness
- e. Formation Hydraulic Conductivity/Permeability
- f. Salinity Profile
- g. Geologic Time Scale

7. Isopach Maps

- a. Upper Confining Zone
- b. Injection Zone
- c. Lower Confining Zone

8. Area of Review (on topographic map showing well locations)

- a. Fixed quarter mile radius
- b. Pressure Buildup Method
- c. Volumetric Reservoir Calculations
- d. Modeling Output (if appropriate)

9. Maps/Cross-Sections showing the vertical and lateral limits of all USDW's within the area of review, and direction of water movement (also show a tabulation of all USDWs stating: 1) Geologic names of all USDWs and 2) Depth to bottom of all USDWs which may be affected by injection).

10. Any other information that the Agency deems necessary in order to make the aquifer exemption determination.